Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Visualization of the spatiotemporal elastohydrodynamic deformation of a compliant thin film under confinement JOELLE FRECHETTE, Johns Hopkins University — Interfacial phenomena in soft matter display complex mesoscale behaviors that are qualitatively different from those encountered in stiff materials. Elastohydrodynamic deformation can cause lift and reduce friction during sliding and alter the rheological properties of colloidal particles. Elastohydrodynamic deformation also modifies the shape of approaching surfaces, a determining factor for the adhesion dynamics to wet or flooded surfaces. It is a challenge to measure simultaneously the hydrodynamic forces and the deformation, both necessary to understand how contact is reached and the coupling between deformation and viscous dissipation.

We will discuss the spatiotemporal deformation of an elastic film during the radial drainage of fluid from a narrowing gap. We observe that the elastic deformation of a thick film takes the form of a dimple and prevents full contact to be reached. With thin elastic film the stress becomes increasingly supported by the underlying rigid substrate and the dimple formation is suppressed, which allows the surfaces to reach full contact. For intermediate film thickness we observe shapes that are much more complex. We present a theoretical description that captures the effect of the film thickness on the elastic deformation and highlight the lag due to viscoelasticity.

Joelle Frechette
Johns Hopkins University

Date submitted: 11 Nov 2016 Electronic form version 1.4